

With Dr. Silks's Compliments

ON THE ADMINISTRATION OF ANÆSTHETICS

IN

NASAL OBSTRUCTION AND NASO-PHARYNGEAL OPERATIONS.

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NASAL OBSTRUCTION

IN ITS RELATION TO THE ADMINISTRATION OF
ANÆSTHETICS.

THERE are but few morbid conditions which have received, of late years, more careful attention than that of nasal obstruction, and it has frequently been shown, that the condition is by no means one which concerns the specialist alone, but, on the contrary, that the patency, or the more or less complete closure of the naso-pharyngeal airway, may greatly influence the general health. The production of artificial anæsthesia by inhalation, is so frequently resorted to, that I hardly need to offer any excuse, for attempting to point out how important are the bearings of such obstruction, upon the process of administration.

Unless the indications to the contrary are very obvious, the administrator naturally concludes, that the anæsthetic vapour reaches the lungs by the usual channels, *i.e.*, the nose and mouth, and mainly the former. If, however, nasal obstruction exists, this double-barrelled, or oro-nasal airway, is converted into a single or oral one in direct proportion to the degree of obstruction. In this connection I would point out—

1. That such anæsthetics as ether, and, in a lesser degree, nitrous oxide, by increasing the turgescence of the mucous membranes, tend to accentuate any slight obstruction that may already exist, or may convert what was originally a partial, and maybe unnoticed, obstruction, into a complete one.

2. That with all anæsthetics, extreme degrees of relaxation, likewise accentuate pre-existing nasal obstruction, by permitting of the falling of the velum palati towards the posterior wall of the pharynx. The proper explanation to give, of the apparent superiority of chloroform for children, appears to me to be, that partial nasal obstruction is then of very frequent occurrence, and that such obstruction, on account of the depressing action of the chloroform, is somewhat less likely to be rendered absolute than with ether; but I think that, when the condition in question is fully recognised by those administering anæsthetics, and precautions taken to obviate any possible difficulty which may arise from this cause, one, at

any rate, of the most serious objections to the use of ether in the young, will be removed.

The conversion of an oro-nasal into an oral airway, should not, of course, under ordinary circumstances, give rise to the slightest anxiety or trouble ; difficulties may, however, then arise under the following circumstances, viz. :—

1. During the stage of induction, on account of the swelling of the tongue which then tends to fill up the only remaining, or oral, airway. This condition is often aggravated, by the abundant secretion of mucus and saliva, and by the spasmodic closure of the jaws and mouth, as a result of the action of the anæsthetic employed ; not only is the inhalation prevented under these circumstances, but a certain degree of asphyxia is also developed ;

2. During the maintenance of the narcosis. Short of absolute occlusion of the glottis by the base, mere contact of the tongue, (even if not swollen), with the roof of the mouth, by obstructing the *oral* airway, is sufficient to add materially to our difficulties. Spasmodic closure of the mouth and jaws likewise ensues in these cases, but rather as a result of the partial asphyxia, than as a cause of that condition.

If the true nature of these difficulties is recognised at the outset, it is comparatively easy to prevent their occurrence, or to overcome them when developed. In the first place then, if nasal obstruction is known, or is suspected to exist, it is always wisest to place a prop between the teeth before commencing the inhalation. Not only is it then easier, subsequently, to insert a gag or mouth-opener, if necessary, but the mouth will be held sufficiently open, to enable us to seize the tongue, should it be desirable to do so.

In the second place, the frequency of more or less complete nasal obstruction, and its tendency to be accentuated under an anæsthetic, should be borne in mind, especially in administering to children. If no prop has been inserted, and if asphyxial troubles arise which do not yield readily to simple measures, *e.g.*, pushing forward the lower jaw, we should endeavour to secure a proper oral airway by the use of the mouth opener or gags. I am inclined to place the importance of opening the mouth, second only to compression of the chest or artificial respiration. With the mouth open, we are rendered independent of the nasal passages ; we can clear away mucus, etc., and pull forward the base of the tongue ; we can command the glottis, and, if need be, proceed to intubate the larynx.

I have been led to devote a good deal of attention to the subject, because of the occasional occurrence, in my own practice, of cases of which the following is almost a typical example, viz. :—

The patient was a lad aged ten ; chloroform was administered by means of a Skinner's frame, and he passed fully and quietly under the influence of the anæsthetic in four minutes, half a drachm being used. The narcosis was maintained subsequently for about ten minutes, towards the end of which time the breathing became slow and shallow, but with nothing approaching stertor ; lividity of the lips then appeared, deepened and extended to the nose and cheeks, but the pulse remained good, and

became almost bounding in character, and the pupils did not dilate ; obviously the danger was due to asphyxia and not to syncope. Dr. HOWARD'S paper upon apnæa, had just then appeared, and this case seemed one in which good might be expected to result from the procedure therein advocated ; the child's head was accordingly brought over the edge of the bed, the shoulders raised, and the neck extended to the very utmost limit, but without appreciable result. I then endeavoured to open the mouth, but the spasm was by that time extreme, and I could only succeed in introducing my forceps just sufficiently to seize hold of the tip of the tongue and draw it forward. Momentary relief was thus afforded, but, unfortunately the jaws were not sufficiently wide apart, the tongue became jammed between the teeth, and the last condition of that boy was decidedly worse than the first. It was not until the jaws were widely opened and the full extent of the oral airway was established, that the patient could be considered out of danger. As I say, this case is but typical of others that have occurred to me and I doubt not to other anæsthetists. The usual explanations given of the phenomena (*e.g.*, aryteno-epiglottidean relaxation), did not appear to me to be quite satisfactory, and it was not until some little time after, that the possibility of nasal obstruction being at the bottom of the mischief impressed itself upon my mind. If my views upon the subject are correct, it might be useful in similar cases, *i.e.*, when oral supervenes upon nasal obstruction, to pass into the pharynx, *via* the nostrils, a good sized gum elastic catheter, in order to furnish means for the passage of air beyond the oral obstruction ; at any rate, the manœuvre is worth trying. Such a catheter might well be added to the armamentarium of the anæsthetist, for it is quite possible to intubate the larynx with such an instrument, should that proceeding be necessary.

If the naso-pharynx itself is the region involved in the operation, additional elements of difficulty in administering are introduced, such as :—

1. The manipulations of the surgeon. When the post-nasal airway is blocked, and the finger, or an instrument, is thrust into the only channel by which the anæsthetic can be administered, it is hardly surprising that the patient tends to asphyxiate, or that, at best, the narcosis is fitful and uncertain ;

2. The profuse haemorrhage attendant upon most operations in this region. Apart from the possibilities of syncope (*e.g.*, in so-called "bleeders"), and complete asphyxia, an accumulation of blood, mucus, etc., in the pharynx and upper parts of the larynx may act in other ways, not the less dangerous because insidious. Thus the glottis being partly occluded, the actual amount of air passing into the lungs is sensibly diminished, and as the vapour of the anæsthetic employed is, as a rule, heavier than air, the diminution takes place, (especially in the supine position), mainly at the expense of the latter ; the vapour, in fact, from sheer force of gravity, gradually tends to displace the air, and to accumulate in the upper part of the larynx. This accumulation explains, I believe, in great measure, how it is that the cases we are considering are particularly prone to the sudden development, of what I have termed elsewhere "Toxicological apnæa."¹

Further, with a diminution of inhalatory power, is of necessity associated, diminished expiratory function and pulmonary elimination, and consequent accumulation of anæsthetic vapour in the lungs and blood. Hence it is not uncommon, for attacks of apnæa and syncope to occur some little time *after* the administration has been discontinued.

Finally, although I have happily had no experience myself in the matter, it is usually taught, and seems quite possible, that blood may be inhaled in such quantities, as to give rise subsequently to atelectasis, pneumonia, and other troubles.

THE CHOICE OF ANÆSTHETICS IN NASO-PHARYNGEAL OPERATIONS.

Dealing with the principal anæsthetics *seriatim*, I propose to point out their relative advantages and disadvantages in reference to this particular class of operations.

Of *local anæsthetics* I have had but little personal experience, and such as I have had has led me to conclude that, even when the use of *cocaine* is possible, its action is very uncertain, and I am confirmed in this opinion by the views, often contradictory, expressed by surgeons who have employed it. These conflicting opinions are, no doubt, due in great measure to the practical impossibility of injecting the drug at or over the seat of operation. Although mere external applications avoid the serious depression which sometimes follows its hypodermic use, this gain is more than counter-balanced by the uncertainty and incompleteness of its action. Add to this the fact that a very large proportion of our patients are either children or nervous women, in whom the dread of the operation, and the sight of the instruments and blood, are even greater disturbing elements than the actual pain, and I think there can be little doubt that the sphere of cocaine is strictly limited, and will possibly become even more so when the present "fashion" dies out.

Nitrous oxide.—The more I see of this agent the more convinced I feel that its use in general surgery is capable of great extension. It is at once pleasant, certain, and safe, and can be administered in any position of the patient. The anaesthesia produced by its use is absolute, no previous preparation is necessary, the recovery is rapid and perfect, and the after effects practically *nil*. The great disadvantage under which it labours is that its effects are very transient, and, owing to the fact that, to be of any service, it must be inhaled pure and absolutely undiluted with air, it is difficult, if not impossible, to maintain the narcosis, especially in naso-pharyngeal operations.

Some uncertainty, too, prevails as to what can really be done, even in the short period of primary anaesthesia at the disposal of the surgeon, when nitrous oxide is used. This period is said to average about thirty-

six seconds ; but, instead of speaking of a definite time, I am in the habit of pointing out that dentists, who have almost a monopoly in the use of the gas, often find the duration of anaesthesia sufficient to permit of the extraction of three or more teeth, and that there must be many operations in general and special surgery which could be easily performed in a similar period. In general surgery it is, of course, possible, though difficult, to maintain the narcosis for considerable periods by alternate removals and rapid re-applications of the face-piece,¹ but this is hardly practicable in the special operations we are discussing. The duration of primary anaesthesia may, however, even in these cases, be considerably prolonged by the judicious use of a very small quantity of ether, and this without materially interfering with the other advantageous properties to which I have referred.

My own experience, as far as operations coming within the sphere of throat surgery is concerned, is limited to tonsillotomies, and a case of exostosis of the septum-nasi, but in all these cases the gas was in every way satisfactory.

Ether.—I have alluded to the use of ether as an adjunct in the production of anaesthesia by nitrous oxide. It may, of course, be given alone from the first, but, by preference, its use should be preceded by a fairly full dose of gas (the so-called combined method), this admixture having the advantage of hastening the development of the anaesthesia, abolishing completely (if properly carried out) the stage of excitement, diminishing the bronchial irritation, and, in short operations, of lessening the tendency to sickness and unpleasant after effects.

The advantages claimed for the use of ether, in these particular operations, are, that next to nitrous oxide it is the safest anaesthetic we have, sufficiently profound anaesthesia is produced and maintained, and that recovery is, on the whole, rapid. Its relative safety, as far as naso-pharyngeal operations are concerned, at any rate, is, I believe, due to the fact that its vapour is very diffusible. This is a point of supreme importance when accumulations of blood and mucus at the back of the throat, and in the larynx, are liable to occur, leading as they do to diminution of both inspiratory and expiratory function. The extreme diffusibility of ether obviates, to a great extent, any danger that may arise on this account, for even with diminished expiration the vapour does not so readily collect in a concentrated form in the lungs as is the case with chloroform.

Further, Paul Bert has drawn attention to the fact,² that during the administration of any anaesthetic there is a stage of comparative safety, bounded on the one hand by the quantity of the drug necessary to produce narcosis, and on the other by the amount required to cause death ; to this period he has applied the term "zone maniable," and it is worthy of note that with ether this zone is comparatively broad. This practically means that the border-land between profound narcosis and death is not

¹ An eminent authority upon the subject of anaesthetics says that this prolongation has been extended to upwards of 20 m.

² *Comptes Rendus Academie des Sciences*, November 14, 1881.

very sharply defined, but allows considerable margin for accidents of over free administration or accumulation. In respect to the after effects of ether, I am inclined to agree with Dr. Dumont,¹ who thinks that although the immediate results of inhalation may be unpleasant, it is seldom that they are of any duration. Finally, ether may be administered with the patient semi-recumbent or even erect.

Against these obvious advantages we must place the following so-called disadvantages, viz.:—

1. That in children and old people it is liable to produce an undue amount of spasm, and almost invariably leads to considerable bronchial irritation. The importance, and much more the frequency of these occurrences, is, I venture to think, considerably overestimated ; among my recorded cases I find seven between six and eight years, and seven between nine and eleven, in none of which was any real difficulty experienced either in respect to spasm or cough.

2. That the haemorrhage and mucous secretions are increased. In respect to the latter this is probably correct, but I doubt very much whether the increased haemorrhage can be proved, nor even, if true, is the objection of any great importance, for with no known agent is the bleeding anything but free ; it is, after all, merely a question of a slight increase, and I have seen no case in which absolute danger from such increased haemorrhage has arisen.

3. That by increasing the turgescence of the vessels the mucous membranes of the nose, the soft tissues of the throat, the tongue, etc., become swollen and more liable to block the air passages. This may be, and is probably true ; inasmuch, however, as the mouth is usually held widely distended with a gag, and the parts in question are within easy reach, the objection on this score practically falls to the ground ; even if this were not the case, any difficulty likely to be caused by this turgescence is capable of easy correction, provided we bear in mind the possibility of its becoming a source of trouble.

4. That the use of ether is forbidden in the neighbourhood of the cautery. This is the general teaching, and on theoretical grounds I am disposed to admit the possibility of accidents occurring under these circumstances ; but I should like very much to hear of some experimental observations upon igniting or exploding ether vapour, in various degrees of tenacity and dilution, by means of the much used galvano-cautery.

On the whole, therefore, I am inclined to think that the objections to ether are not of such great weight, or of such importance, as to warrant us in disregarding its obvious and great advantages.

Chloroform.—For some reason which is not at once apparent, chloroform has long been almost the routine anaesthetic in naso-pharyngeal operations. I believe myself that such use is founded upon the assumption that it is safest for children—a general proposition with which I in no way agree, and from which I fancy its use has extended to adults. Other advantages claimed for it in these operations are :—

¹ *Correspondenz-Blatt für Schweiz. Aerzte*, 1888.

1. That it is simple to administer, and the resulting narcosis is easily maintained. It does not come within the scope of this communication to point out that these advantages are much exaggerated, but even if this were not the case, I hardly think that the convenience of the operator should be placed above the safety of the patient.

2. That the bleeding and turgescence of the mucous membrane is less than when ether is used, but even if this were true, the difference, as I have already pointed out, is so slight, that this advantage almost sinks into insignificance.

3. That the primary narcosis is more profound. This should, I think, be classed rather as a disadvantage, inasmuch as the zone maniable to which I have already referred, is, in respect to chloroform, very narrow, and, therefore, even if no respiratory embarrassment prevailed, its use is always attended with a certain amount of risk : much more is this the case when the comparatively pure vapour which accumulates at the back of the throat may be inhaled at any time, and is quite beyond our control.

These, as far as I know, are the only advantages which, even indirectly, can be said to have any bearing on the special cases we are considering. The objections to its use, if not numerous, are weighty :—

1. I can fully endorse the view that chloroform administrations are always a source of anxiety to the anæsthetist, and, in some instances of "narrow escapes" to the patients, and this is much more the case in naso-pharyngeal operations. On account of the accumulation of blood at the back of the throat, and consequent interference with the respiratory functions, the heavy chloroform vapour speedily collects above the larynx in a nearly pure or highly concentrated state. Hence the attacks of syncope and apnœa which so commonly occur, without the slightest warning, when chloroform is being administered. Its slight diffusibility, too, tends to permit of its accumulation in the lungs, and is accentuated by the respiratory failure. Hence the attacks of syncope and apnœa occurring, as they frequently do, some time *after* the administration has been withdrawn.

2. The after effects of chloroform are often very prolonged. Such immediate effects as sickness, the result of the blood swallowed, are probably no better and no worse than those attendant upon the administration of ether, but profound prostration and digestive disturbance are said to continue for days.

3. Its administration in any but the absolutely recumbent position is quite inadmissible.

Mixtures.—In this country much faith is placed in such mixtures as the A. C. E., or in others containing more or less chloroform. For reasons which are hardly necessary for me to discuss here, I incline to the opinion that, as the strength of a chain is measured by its weakest link, so the safety of any anæsthetic mixture must be determined by its most dangerous component. When, therefore, mixtures of this description are used, I believe that the same objections to their use arise as with chloroform alone.

Where for any reason primary narcosis has been induced by chloroform, I am in the habit of substituting—very early—ether, administered by the same method as adopted for the former, *i.e.*, Skinner's cage or lint. I have seldom, if ever, found this to fail, and should certainly not care to maintain narcosis with chloroform alone for any prolonged period without some similar arrangement.

Summary.—The conclusions to which my own experience leads me are, then, as follows :—

1. That the possibility of using nitrous oxide should always be considered in naso-pharyngeal operations of short duration.
 2. Failing this, the advantages and disadvantages of ether, and by preference, of the combined method, should be carefully weighed before deciding the question.
 3. That chloroform, though so frequently used, has, over and above the objections made to it upon general grounds, drawbacks special to these particular operations, and when employed ether should be substituted at as early a stage as possible.
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METHODS OF ANÆSTHETISATION IN NASO-PHARYNGEAL OPERATIONS.

IN a previous communication to this Journal, I made some remarks upon the choice of anæsthetics in naso-pharyngeal operations. The subject would obviously be incomplete, without some reference to the methods usually adopted, in administering the various anæsthetics alluded to in that article, including, under this head, questions relating to the position of the patient, as well as those concerning the actual inhalation.

POSITION OF THE PATIENT.

This, of course, is determined almost entirely by the surgeon, but the position selected, and, it may be added, the proposed mode of operating, may materially influence the judgment of the administrator, as to the choice of the anæsthetic, and the method to be adopted in its use, and, at the same time, may give him some idea as to the nature of the difficulties which may arise.

RECUMBENT POSITIONS.

(a) *Supine.*—If this position is chosen, the shoulders should be well raised, and the head supported comfortably on a pillow. After the primary anæsthetisation, *i.e.*, before the operation is commenced, the pillow beneath the head may be withdrawn, and the patient so arranged that his head may fall over the end of the couch or bed. Although this manœuvre renders the performance of the operation a little more difficult,

it is really of great service, especially in children and thin adults, for by a further slight extension of the neck, the naso-pharynx is placed on a lower level than the mouth, and much blood will escape by the nose. The chief advantage claimed for this position is, that the primary narcosis may be more profound, and the patient is, therefore, more completely under control. But we are here met with this difficulty—is it better to place the patient very fully under the influence of the anaesthetic, and so abolish all reflex acts, or is it to be administered in only just sufficient quantity to prevent pain, the patient still retaining the power of swallowing accumulated blood and mucus? When ether is the anaesthetic used, I have myself little hesitation in pushing the administration to its extreme limit in these cases, if the surgeon wishes, for with the mouth widely open one can command the glottis, and remove the blood almost as quickly as it collects, and, as I have pointed out in my previous paper, the extreme diffusibility of ether vapour greatly reduces the risk of over-anæsthetisation. When chloroform is used the alternative procedure is, I feel sure, the right one (and I prefer it myself even with ether), although I admit that it is the most troublesome, involving, as it does, extreme vigilance on the part of the administrator.

It must never be forgotten, that the risk in naso-pharyngeal cases depends rather upon over anæsthetisation than anything else, and the degree of anæsthetisation is not always quite under the control of the administrator, *e.g.*, when impaired expiratory power permits of an accumulation of vapour in the lungs, &c.

The objections to the supine position are, that the nasal obstruction is increased by the falling of the velum palati; that the tongue very readily slips backwards, and, most important of all, that the blood readily accumulates in the upper part of the pharynx and larynx, and this in spite of extreme extension of the neck, in fact much of the blood must either be swallowed or be wiped out with sponges. I cannot say that I have myself ever seen a patient's life placed in actual jeopardy from mere accumulation of blood, but I can quite conceive the possibility of danger arising, and most certainly, it may seriously embarrass the breathing and lead to subsequent trouble, *e.g.*, post operative syncope and apnæa.

(b) *Prone.*—When no general anaesthetic is employed, or if the haemorrhage were the only difficulty to be contended against, there can be no doubt that the *prone* position would be of great service. With the patient lying on his face accumulations of blood at the back of the throat tend to flow naturally out of the mouth almost as fast as they are formed; not only so, but the tongue, velum palati, &c., fall away from, rather than into, the upper part of the larynx. Unfortunately, however, if a general anaesthetic is used, the dangers attendant upon compression of the chest, and consequent embarrassment of the respirations, render this position almost impossible. Even if this were not the case, the surgeon would have to depend entirely upon the primary narcosis, which would have, therefore, to be very profound, for with an anaesthetic vapour heavier than air, it would be next to impossible to continue its use with any satisfaction during the operation.

Even if primary narcosis is induced while supine, and the patient

is then turned on his face, the difficulties are not diminished, while the dangers are obviously increased, on account of the interference with the elimination of the anæsthetic, from the already overcharged lungs and blood.

(c) Primary anaesthetisation on the back, and turning the patient upon the side during the operation, has, from the anæsthetist's point of view, fewer objections than the absolutely prone position, but its advantages over the supine position are but slight. It is true, that a little more blood may thus be induced to fall out of the mouth, but the amount thus got rid of, is not sufficient to compensate, for the dangers attendant upon the compression of one side of the chest.

ERECT.

(a) *Sitting.* — For slight operations, e.g., tonsillotomy, cauterisations, etc., when profound anæsthesia and complete relaxation are not required, this position is a good one. The chair chosen should be high-backed and with arms, and should, by preference, be covered with velvet (which helps to prevent slipping), or a "dental chair" may be employed. If there is any haemorrhage the body may be bent well forward, with but slight impediment to the breathing, and the blood will then flow freely out of the mouth. The advantages of this position seem to me to be, that there is less danger of over anaesthetising the patient; that the mouth may very readily be emptied of unswallowed blood, and that the narcosis can be maintained. The disadvantages are—the tendency of the patient, if deeply under, to slip out of the chair, and the difficulty of wiping out the throat, if excessive haemorrhage renders such a proceeding necessary.

(b) A modification of the erect position is much in vogue, in such operations as scraping away adenoid growths with the finger. The patient is seated in a chair, with the legs supported, and the body nearly upright; having been fairly deeply anaesthetised, his body is bent well forward, so that his head is over a basin placed between his knees; the operation is then performed, the blood flowing out by the side of the surgeon's finger. I have assisted at many such operations, and think this position an excellent one, and can only regret that, as the bending forward of the body to be of any service must be very decided, and that it is impossible to continue the administration during that period, its applicability to operations about the mouth is practically limited to those mentioned, i.e., scraping adenoid growths.

On the whole I am inclined to think that as far as the anæsthetist is concerned, the possibility, or impossibility, of operating in the erect position, or in the modification of that position above referred to, should always be carefully considered before adopting any other.

METHOD OF ADMINISTRATION.

In order to deal systematically with the question of actual inhalation, I shall refer briefly to the methods I have myself found to succeed best, without claiming for them any marked superiority over methods, which, in other hands, may appear preferable.

Local applications come rather within the sphere of the surgeon than the anæsthetist, and I need not therefore refer further to them.

Nitrous Oxide.—The apparatus used, and the manipulations necessary,

are rather too complicated for description in this paper, full details are given in my work on the subject,¹ to which I would refer those interested in the matter. In this particular class of operations, it is of course absolutely necessary to prop the mouth open before commencing the inhalation; in fact, the procedure and degree of anaesthetisation are precisely those required in dental work. Before commencing the operation (*e.g.*, tonsillotomy), a Mason's gag is inserted between the teeth, and the mouth-prop removed; if a full sized facepiece is used, a few more whiffs of gas may then be given. In using this gag, care should be taken not to injure the teeth, and to avoid lacerating the gums, by pressure against the dental margins. I have also seen the soft palate severely bruised by the use of a large gag in a small child. Re-application of the facepiece, after the commencement of the operation, is only possible when the bleeding is but slight.

For the introduction of a small quantity of ether vapour, during the administration of gas, a small modified Clover's portable ether chamber is arranged between the facepiece and gas bag. No ether is introduced for the first six or eight inhalations (three or four in children), after which the chamber is rotated steadily and evenly, until all the gas inhaled passes over the ether contained in the reservoir. Nitrous oxide may be administered in any position, almost preferably when erect, and the small dose of ether suggested does not affect this statement.

Ether and the combined method.—If the degree of relaxation required is not extreme, I have myself no objection to administering ether in the erect or semi-erect position. With profound narcosis, however, it is difficult to retain this position, and the patient therefore should be supine. The apparatus used is that so well-known as Clover's portable ether chamber, with the expiratory bag so arranged as to be capable of distension with gas. For the first two or three inspirations, gas alone is breathed, the ether chamber is then very gradually rotated, choosing, by preference, the period of expiration for each increment of ether. It is seldom necessary to proceed much beyond the stage when the index points to 2 (*i.e.*, half ether). Before commencing, the mouth should be propped open as for gas.

The narcosis may be maintained by continual re-applications of the facepiece, the blood being cleared away beforehand; or by means of a gum elastic catheter, attached to a Junker's inhaler, and passed into the mouth, the bottle of the inhaler being filled with ether. It must be confessed that neither of these proceedings is very satisfactory, but, on the other hand, it must be recollected that the difficulty lies, not in the introduction of the vapour, but in making it pass the glottis. I do not think either, that anything is really lost by proceeding as deliberately with these, as with other operations in general surgery, and arresting the flow of blood caused by one incision before making another. Ether, may, too, be administered quite effectually upon a Skinner's cage, but primary narcosis is difficult to produce by this means; it answers very well, however, for maintaining the anaesthesia induced by chloroform.

Chloroform.—Administration of this drug in any but the supine

¹ A Manual of Nitrous Oxide Anesthesia.

position is quite inadmissible. The mouth need not be propped open before commencing, but perhaps it is better to do so. I always use the so-called Skinner's inhaler or cage and a drop bottle, and it will be found of advantage in children and nervous women, to commence the inhalation with a little Eau-de-Cologne or other scent. The covering of the cage should be domette or a coarse flannel; fine textured coverings are wasteful, and do not allow of a free admixture of air. Ordinary flannel too by repeated washing, tends to become gradually more close in texture. The anæsthesia may be maintained by means of the corner of a towel, or a Junker's inhaler containing chloroform, but I prefer myself to continue the use of the Skinner throughout, for reasons similar to those given above, when discussing the maintenance of ether narcosis, and also because I think there is less danger of over anæsthetising the patient, which may very readily be done with such a substance as chloroform, the vapour of which is so much heavier than air.

Mixtures.—Little need be said concerning the administration of mixtures; it may be laid down as a general rule, that mixtures containing the *slightest trace* of chloroform, should be given in precisely the same way as that agent. Mixtures of ether and alcohol alone, may be administered as ether.

In maintaining chloroform narcosis, I not infrequently use mixtures of that drug, either with ether alone or with alcohol and ether on a Skinner's cage, or from a Junker, but I do so rather with a view to diluting the chloroform, than with the idea that any superiority attaches to such combinations.

A very satisfactory method of administration is to induce profound narcosis by the combined method (gas and ether) above alluded to, and to maintain the anæsthesia by means of chloroform, using for this latter purpose a Junker's inhaler and tube.

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